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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/782,494	02/13/2001	Stephen L. Buchwalter	Y0R920000745US1(14029)	9921
7590	07/12/2004		EXAMINER	
RICHARD L. CATANIA, ESQ. SCULLY, SCOTT, MURPHY AND PRESSER 400 GARDEN CITY PLAZA GARDEN CITY, NY 11530			NGUYEN, KHIEM D	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 07/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	09/782,494	BUCHWALTER ET AL.	
	Examiner Khiem D Nguyen	Art Unit 2823	
<i>-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --</i>			
<b>Period for Reply</b>			
<b>A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.</b>			
<ul style="list-style-type: none"> <li>- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.</li> <li>- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.</li> <li>- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.</li> <li>- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).</li> <li>- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).</li> </ul>			
<b>Status</b>			
1) <input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>29 April 2004</u> .			
2a) <input type="checkbox"/> This action is <b>FINAL</b> .		2b) <input checked="" type="checkbox"/> This action is non-final.	
3) <input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i> , 1935 C.D. 11, 453 O.G. 213.			
<b>Disposition of Claims</b>			
4) <input checked="" type="checkbox"/> Claim(s) <u>1-32</u> is/are pending in the application.			
4a) Of the above claim(s) <u>23-32</u> is/are withdrawn from consideration.			
5) <input checked="" type="checkbox"/> Claim(s) <u>21 and 22</u> is/are allowed.			
6) <input checked="" type="checkbox"/> Claim(s) <u>1-20</u> is/are rejected.			
7) <input type="checkbox"/> Claim(s) _____ is/are objected to.			
8) <input type="checkbox"/> Claim(s) _____ are subject to restriction and/or election requirement.			
<b>Application Papers</b>			
9) <input type="checkbox"/> The specification is objected to by the Examiner.			
10) <input checked="" type="checkbox"/> The drawing(s) filed on <u>13 February 2001</u> is/are: a) <input checked="" type="checkbox"/> accepted or b) <input type="checkbox"/> objected to by the Examiner.			
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).			
11) <input type="checkbox"/> The proposed drawing correction filed on _____ is: a) <input type="checkbox"/> approved b) <input type="checkbox"/> disapproved by the Examiner.			
If approved, corrected drawings are required in reply to this Office action.			
12) <input type="checkbox"/> The oath or declaration is objected to by the Examiner.			
<b>Priority under 35 U.S.C. §§ 119 and 120</b>			
13) <input type="checkbox"/> Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).			
a) <input type="checkbox"/> All b) <input type="checkbox"/> Some * c) <input type="checkbox"/> None of:			
1. <input type="checkbox"/> Certified copies of the priority documents have been received.			
2. <input type="checkbox"/> Certified copies of the priority documents have been received in Application No. _____.			
3. <input type="checkbox"/> Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).			
* See the attached detailed Office action for a list of the certified copies not received.			
14) <input type="checkbox"/> Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).			
a) <input type="checkbox"/> The translation of the foreign language provisional application has been received.			
15) <input type="checkbox"/> Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.			
<b>Attachment(s)</b>			
1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)		4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____.	
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)		5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)	
3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.		6) <input type="checkbox"/> Other: _____.	

## **DETAILED ACTION**

In view of the arguments presented in the Appeal Brief filed April 29<sup>th</sup>, 2004, prosecution on the merits is reopened to address the issues raised in the Brief. The grounds of rejections in the prior Office actions are withdrawn, and new grounds of rejection are presented here. 37 CFR 1.193 (b)(2) applies:

(2) Where prosecution is reopened by the primary examiner after an appeal or reply brief has been filed, appellant must exercise one of the following two options to avoid abandonment of the application:

- (i) File a reply under § 1.111, if the Office action is not final, or a reply under § 1.113, if the Office action is final; or
- (ii) Request reinstatement of the appeal. If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (§ § 1.130, 1.131 or 1.132) or other evidence are permitted.

The Declaration filed on April 05, 2004 under 37 CFR 1.131 is sufficient to overcome the Coyle (U.S. Pub. 2002/0105092) reference.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilleo et al. (U.S. Patent 6,228,678) in view of McCarthy et al. (U.S. Patent 6,346,296).

In re claims 1 and 20, Gilleo discloses a method of forming a microelectronic interconnect structure containing a bilayer underfill layer comprising the steps of (FIGS. 1-5 and related text):

- (a) forming a first polymeric material (FIG. 1: 14) composed of epoxies has a thickness of from about 25 to about 100 microns by a deposition process such as spin coating on a surface of a semiconductor wafer (FIG. 1: 12) having interconnect pads (FIG. 1: 15) disposed thereon and the wafer has one or more devices present therein and the first polymeric material further includes an inorganic filler comprises of silica wherein the inorganic filler is present in the first polymeric material in an amount of from about 10-80 % by weight (col. 5, lines 11-37);
- (b) patterning said first polymeric material to provide openings (FIG. 2: 16) that expose the interconnect pads by etching (col. 9, lines 7-17);
- (c) forming conductive bump material (FIG. 3: 18) such as solder bumps in the openings by a plating method (col. 9, lines 18-23);
- (d) forming a second polymeric material (FIG. 4: 20) composed of flux material over the first polymeric material and the conductive bump material wherein the second polymeric material has a thickness that is thinner than the first polymeric material (col. 9, lines 24-33);
- (e) dicing said semiconductor wafer into individual chips (col. 6, lines 53-61); and
- (f) bonding at least one of the individual chips to an external substrate such as circuit board or chip carrier, wherein during bonding the conductive bump material

penetrates the second polymeric material and contacts a surface of the external substrate (col. 6, lines 53-61);

Gilleo discloses forming a second polymeric material composed of flux material atop the first polymeric material and the conductive bump material but fails to teach partially cured to a B-stage state the polymeric material.

McCarthy discloses forming a polymeric material that is partially cured to a B-stage state (col. 3, lines 45-55). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Gilleo and McCarthy to enable the second polymeric material that is partially cured to a B-stage state of Gilleo to be formed and furthermore to obtain packaging substrate which can be used for the high density interconnection of semiconductors and other components in the electronic industry (col. 3, lines 45-55).

In re claims 2 and 3, Gilleo discloses wherein the first polymeric material is formed by a deposition process selected from the group consisting of spin coating (col. 5, lines 11-20).

In re claims 4 and 5, Gilleo discloses wherein the first polymeric material is a dielectric polymeric material selected from the group consisting of polyimides and epoxies (col. 7, line 29 to col. 8, line 63).

In re claims 6-8, Gilleo discloses wherein the first polymeric further includes an inorganic filler comprises silica (col. 8, lines 25-42) wherein the inorganic filler is present in said first polymeric material in an amount of from about 60-70 % by weight (col. 7, line 58 to col. 8, line 4).

In re claim 9, Gilleo discloses wherein the first polymeric material has a thickness of from about 25 to about 125 microns (col. 5, lines 20-37).

In re claim 10, Gilleo discloses wherein the wafer is composed of a semiconducting material and has one or more devices present therein (col. 6, lines 53-61).

In re claim 11, Gilleo discloses wherein step (b) includes lithography and etching (col. 9, lines 7-7 and FIG. 2).

In re claim 12, Gilleo discloses wherein the conductive bump material 18 is solder (col. 9, lines 7-23).

In re claim 13, Gilleo discloses wherein the conductive bump material is applied to the openings by injecting molding, evaporation, plating, or a paste screening process (col. 6, lines 11-24 and col. 9, lines 7-23).

In re claim 14, Gilleo discloses that the first polymeric material is formed by spin coating but does not explicitly disclose the second polymeric material is formed by spin coating (col. 8, lines 43-63). However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to apply Gilleo's teaching to form the second polymeric material by spin coating because doing so can provide a smooth and level coating (col. 5, lines 11-15).

In re claim 15, Gilleo discloses wherein the second polymeric material includes a fluxing agent and an adhesive (col. 8, lines 43-63 and col. 9, lines 24-34).

In re claim 16, Gilleo discloses that the first polymeric material is a thermoplastic but does not explicitly disclose the second polymeric material is a thermoplastic (col. 8, lines 43-63). However, it would have been obvious to one of ordinary skill in the art of

making semiconductor devices to apply Gilleo's teaching to form the second polymeric material such that the second polymeric material is a thermoplastic because doing so can eliminate the problems associated with thermoset underfills (col. 7, lines 29-32).

In re claim 17, Gilleo discloses wherein the second polymeric material has a thickness that is thinner than the first polymeric material (element 20 or 20' is thinner than element 14 in FIGS. 4-5).

In re claims 18 and 19, Gilleo does not explicitly discloses the thickness ranges of the second polymeric material and the temperature and time duration of the bonding step. However, there is no evidence indicating that the thickness of the second polymeric material and the temperature and time duration of the bonding step is critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

*Allowable Subject Matter*

Claims 21-22 are allowed.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



W. DAVID COLEMAN  
PRIMARY EXAMINER

K.N.  
July 8, 2004